Method for packaging containers automatically

The invention relates to a method for automatically packaging empty containers, such as collapsible tubes or the like, that are supplied by a conveyor belt, into a plurality of packaging containers that take up empty containers.

Methods for the manufacture of containers that are, in principle, circular or elliptical in cross-section, practically cylindrical containers with invariable cross-sections, such as preferrably collapsible tubes, cans or tubes, are, for example, known from DE 26 43 089 A1 and WO 91 15349, in particular for collapsible tubes. The collapsible tubes thus manufactured can be packaged by a collapsible tube packaging machine to form larger product units which can then be supplied to a filling company. The packaging machinges required to this end are, for example, known from EP 1 114 784 B1.

Both the manufacturing machines and the packaging machines permit manufacture and packaging respectively of approx. 200 up to no more than 250 units per minute. For the future, however, production and packaging rates are desirable that are within a range of ±500 units per minute. At present, such machines for the manufacture of collapsible tubes are under development and, in part, already in production. Automatic packaging machines with such a high rate of units per minute have not yet been developed because, at such high speeds, the times available for loading individual rows of collapsible tubes are very short. What is more, the problems arising in connection with the time available and with the loading rates are further aggravated because the collapsible tubes are often top-heavy. Furthermore, the time available for changing a packaging container is also insufficient, for example when a last row and a first row are loaded in two successive packaging containers, for example boxes; as a result, the speed cannot be increased.

It is the object of the invention to create a method for automatically packaging empty containers, such as collapsible tubes or the like, that are supplied by a conveyor belt, into a plurality of packaging containers that take up empty containers, said method facilitating high packaging rates of 500 and more containers per minute without any critical cycle times.

This problem is solved by the characteristic elements of Claim 1.

Advantageous embodiments of the invention are disclosed in the subordinate claims.

Below, the invention will be illustrated in more detail with reference being made to drawings, in which:

Fig. 1	is a view of an apparatus for applying the method according to the invention;
Fig. 2	is a rear view of the apparatus according to Fig. 1;
Fig. 3	is a view of a collection apparatus and of a continuously running feeder belt;
Fig. 4	is a view of a single rotatable suction vee;
Fig. 5	is a view of two transfer units and one loading plate for the rows of tubes having accumulated in a collection apparatus and loaded into a packaging container;
Fig. 6	is a view of a partially loaded apparatus for ganging a row of collapsible tubes without any gap;
Fig. 7	is the same view as shown in Fig. 6, however, of a compacted row of collapsible tubes;
Fig. 8	is a view of different positions of various packaging containers;
Fig. 9	is a sectional view of an intermediate storage; and
Fig. 10	is a view of two different types of packaging collapsible tubes.

For the most part, the figures shown are schematic representations. A few variants of further executive forms are indicated in the description below.

Below, the invention will be illustrated in more detail by means of an exemplary embodiment.

As shown in Fig. 1, containers that are approximately cylindrical in shape, such as cans or tubes or the like, here collapsible tubes 1, are continuously supplied from a manufacturing unit HE onto a feeder belt 2 on individual vee-shaped conveyor trays 3 which are forming the feeder belt 2. The

vee-shape of the conveyor trays 3 enables such containers to be taken up without having to be changed, wherein the cross-sections of these containers are varying within a wide range. At its end, the feeder belt 2 is provided with a collection apparatus 4, here comprising eight separately driven rotatable suction vees 5. The rotatable suction vees 5 take up the collapsible tubes 1 from the feeder belt 2 one after the other and - in the executive example - deliver the collected collapsible tubes 1 in rows of eight or seven respectively in two cycles to fifteen holders 6 of a group transfer unit 7. The holders 6 are connected to a suction line and comprise parallel recesses that are uniformly spaced apart from each other; the collapsible tubes 1 that have been taken up from the feeder belt 2 and delivered by means of the suction vees 5 are supplied into said recesses. The group transfer unit 7 transfers the formed rows of collapsible tubes 1 into a ganging apparatus 8 that, in the executive example, comprises fifteen collapsible tube holding vees 9.

The axial spacing of the fifteen collapsible tubes 1 thus deposited still corresponds to the spacing of the conveyor trays 3, i.e. the said tubes are arranged at the same pitch (see Fig. 6). In order to achieve a tight and closed packing of the collapsible tube rows, the collapsible tubes 1 must be 'compacted' such that they are positioned adjacent to one another or are in contact with one another. Each row, in the executive example comprising fifteen compacted collapsible tubes 1 that are in contact with one another, is then deposited on lowerable bottom strips 12 of an intermediate storage 13 by a row transfer unit 10 with holding suction cavities 11 that are arranged according to a 'compacted' row (see Fig. 7). The bottom strips 12 are then lowered in steps to take up a next row of compacted collapsible tubes 1. The lowering in steps is carried out until a desired number of rows has formed, for example five rows; thereafter, a greater lowering movement is effected, whereby the five rows of collapsible tubes are placed on the firm base 15 of the intermediate storage 13. The intermediate storage 13 may have the shape of a case one moving lateral wall of which is provided as a slide 16 which permits all collapsible tubes 1 collected in the intermediate storage 13 to be transferred, in a sliding movement, into an empty or already partially filled box 14 that is arranged behind the intermediate storage 13. Depending on its size, the box 14 may already been filled in part and/or require further batches of collected collapsible tubes 1 for being filled completely.

The initially empty box 14 is arranged in a vertical position behind the intermediate storage 13 and is lowered in steps by a holding fork 17 according to its filling degree. By means of a swivel

drive 18, the holding fork 17 is arranged at a linear drive 19 for vertical adjustment. The linear drive 19 permits the holding fork 17 to be placed at various levels that can each be activated preferrably by a mechanical or automatic control system (not illustrated).

Once an empty box 14 is filled with the desired number of collapsible tubes 1, it is turned by 90 degrees from the position behind the intermediate storage 13 by means of the swivel drive 18 and placed on a conveyor belt that may, for example, be designed as a finger belt 20, so that the holding fork 17 can comb through the finger belt 20 into a position below the finger belt 20. On a conveyor belt that is preferrably arranged laterally and is, for example, designed as a roller conveyor 21, the full box 14' is then conveyed to a filling machine (not illustrated) or a store (not illustrated).

Once the full box 14' has released the finger belt 20, the holding fork 17 is moved from its bottommost position to its topmost position by the linear drive 19, while first combing through the first lower finger belt 20 and then through a second upper finger belt 20' arranged parallel to the first finger belt and spaced apart therefrom in height and taking up a new empty box 14 that has been supplied beforehand, for example by a conveyor belt that may, for example, be designed as a second roller conveyor 21'. After having taken over the empty box 14 from the upper finger belt 20', the holding fork 17 briefly remains in an - uppermost - position just a little above the upper finger belt 20' where, by means of the swivel drive 18, it is turned by 90 degrees, so that the opening of the box 14 is directed towards the intermediate storage 13, and moved behind the intermediate storage 13 and down to the required working level that is stored if necessary, where it can take up any number of batches of further collapsible tubes 1 until the empty box 14 is filled.

If necessary, further empty boxes 14 can be supplied via the roller conveyor 21' and to the upper finger belt 20' by a preferrably controllable stop 22.

The above general illustration of the overall invention will be followed by a description of the individual steps below.

The collection apparatus 4 assigned to the feeder belt 2 for collapsible tubes 1 comprises suction vees 5 that are provided with a number of eight suction vees 5 in the executive example (see Fig. 3). The suction vees 5 are driven separately and are mounted between the feeder belt 2 and the group transfer unit 7 such that they can be rotated about parallel axes and, in a first step, take up eight and,

in a second step, seven collapsible tubes 1 from the conveyor trays 3 of the feeder belt 2, so that a total of fifteen collapsible tubes 1 are taken up by the group transfer unit 7. It is also possible to provide more or less than eight suction vees 5 in order to take up more or less collapsible tubes 1 from the feeder belt 2.

At the transfer sites A, B, C, D, E, F, G, H at the collection apparatus 4, collapsible tubes 1 approaching on the feeder belt 2 are taken up by the suction vees 5 that are assigned to each transfer site A through H, as shown in Fig. 3. In Fig. 3, the transfer sites A through D are already occupied. However, the following conveyor trays 3 are unoccupied, and there are gaps L. If having been present there formerly, the collapsible tubes were discarded and already separated, for example by an upstream control system, thus causing gaps L.

If a gap L is now approaching the unoccupied transfer site E, the respectively last assigned suction vee 5 that is not yet occupied by a collapsible tube 1 is not activated, i.e. the empty conveyor tray 3 passes through the collection apparatus 4. The suction vee 5' at the transfer site E is activated only when a collapsible tube 1 approaches in a conveyor tray 3. If, for example, an optical sensor (not illustrated) detects that a collapsible tube 1 approaches the transfer site E and, thus, the assigned suction vee 5', the suction vee 5' is turned in direction of the arrow (see Fig. 4) and the collapsible tube 1 is taken over within the range of P1, is rotated to be transferred and, at position P2, is delivered to the group transfer unit 7 and into the holders 6 a_1 to h_1, wherein the linear velocity V_1 of the conveyor trays 3 and, thus, of the collapsible tubes 1 on the feeder belt 2 and the tangential velocity V_2 of the rotatable suction vees 5 are approximately equal or synchronous, at least at the time of collapsible tube takeover at P1.

Once all of the transfer sites A through H are loaded with collapsible tubes 1 and the latter are delivered to the holders 6 at the eight positions a_1 through h_1, this is followed by a further collapsible tube 1 loading cycle at positions A through G and by a successive corresponding takeover of now only seven collapsible tubes that are now delivered to the holders 6 i_1 to o_1 of the group transfer unit 7 (see Fig. 3) at position P3 (see Fig. 4). The suction vee 5 assigned to the transfer site H is operated only at every first cycle, whereby an alternating sequence of eight collapsible tubes in the first cycle and seven collapsible tubes in the second cycle and, thus, loading of the group transfer unit 7 with fifteen collapsible tubes 1 is enabled. Before taking up the seven collapsible tubes 1 in the second

cycle, the group transfer unit 7 is lifted a little, in order to enable the takeup of the still missing seven collapsible tubes at position P3.

Fig. 5 illustrates the takeup position P4, for example for eight collapsible tubes 1 of a first cycle, as well as a slightly turned neighboring position 4' that is briefly approached by the group transfer unit 7 after having taken up the eight collapsible tubes 1. Thereafter, the group transfer unit 7 returns to position P4 to take up the seven collapsible tubes 1 in the second cycle, so that the group transfer unit 7 is loaded with a total of fifteen collapsible tubes 1. Then it turns to position P5 where all of the fifteen collapsible tubes 1 are placed in a ganging apparatus 8 with holding vees 9.

The holding vees 9 (see Figs. 6, 7) of the ganging apparatus 8 contain suction cavities, i.e. negative pressure is applied to the collapsible tubes 1 present thereon, whereby the collapsible tubes 1 are held on the holding vees 9.

The ganging apparatus 8 comprises fifteen holding vees 9 that are spaced apart from each other. The holding vees 9 including collapsible tubes 1 are slidable, e.g. arranged on two bars 23 where they can be pushed together such that they are all in contact with one another, i.e. all collapsible tubes 1 of a row are in lateral contact with one another (see. Fig. 7). The formed row of fifteen collapsible tubes 1 that are touching each other is taken up by means of the row transfer unit 10 with suction cavities 11 at position P5 (see Fig. 5) and, after a swivel movement (see arrow in Fig. 5), transferred on lowerable bottom strips 12a, 12b, 12c of the intermediate storage 13 at position P6 and placed thereon.

If it is desired to have the collapsible tubes 1 packed in the boxes 14 as closely as possible, the row transfer unit 10 makes a lateral deflecting movement (represented schematically in Fig. 7 by the arrow between positions P7 and P8), so that alternating packing of the collapsible tubes 1 (see Fig. 10b) can be achieved, i.e. a type of packing where the collapsible tubes 1 of each successive row are placed in a staggered arrangement. It is, however, also possible to provide a type of packing (see Fig. 10a) where the rows are arranged exactly one on top of the other.

After a row of collapsible tubes 1 has been placed on the lowerable bottom strips 12a, 12b, 12c of the intermediate storage 13, the bottom strips 12a, 12b, 12c are lowered by an amount that corresponds to the particular packing pattern desired (see, for example, Figs. a and b). If the packing

is close, i.e. with a higher filling degree (see Fig. 10b), the lowering movement is equal to the respective collapsible tube diameter multiplied with a factor of 0.5 x √?3; if the packing is loose according to Fig. 10a, the lowering movement is equal to the collapsible tube diameter. Thereafter, further rows are placed and further lowering movements are made, until the respectively desired number of rows or the desired filling degree of a box 14 is achieved.

Once the bottommost layer of stored collapsible tubes 1 reaches the base plate 15 of the intermediate storage 13, wherein the base plate 15 is arranged in a non-removable manner and is provided with cutouts for passage of the bottom strips 12a, 12b, 12c, the slide 16 transfers all collapsible tubes 1 collected in the intermediate storage 13 into an empty or partially filled box 14, wherein adjustable lateral guides 24 that can be adjusted to the particular collapsible tube diameter and the type of packing by any adjusting devices (not illustrated) are provided. The intermediate storage 13 also contains an upper front limiting plate 25 that is arranged at a distance and can, if necessary, also be lowered, in order to permit passage of one, if necessary even more rows of collapsible tubes. Furthermore, a rear limiting plate 25' is provided the distance of which is adjusted to the collapsible tube length and which is also used to stabilize the collapsible tubes 1 already transferred into the intermediate storage 13 while they are being stored in the intermediate storage 13.

According to a preferred executive form, two sets of bottom strips 12a, 12b, 12c and 12a', 12b', 12c' are arranged in the intermediate storage 13 on three cooperating chain drives 26a, 26b, 26c. All are jointly driven by a single motor via a sprocket wheel shaft 27. After the bottommost of all rows of collapsible tubes 1 stored on the bottom strips 12a, 12b, 12c in the intermediate storage 13 has reached the base plate 15 and the slide 16 transfers all collapsible tubes 1 into a box 14 or loads said box 14 with all collapsible tubes 1, further rows of collapsible tubes 1 are grouped to form a further collapsible tube package in the intermediate storage 13 by means of the chain drives 26a, 26b, 26c and the additional bottom strips 12a', 12b', 12c'. Since the two sets of bottom strips 12a, 12b, 12c and 12a', 12b', 12c' are arranged on the chain drives 26a, 26b, 26c in a staggered manner and, with equal chain lengths, are driven by a single joint sprocket wheel shaft 27, the chain drives 26a, 26b, 26c each comprise different sequences that compensate their respectively different arrangement.

As shown in Fig. 2 and Fig. 8, the holding fork 17 is connected to a vertically adjustable linear

drive 19 via a swivel drive 18, thus providing the possibility of moving to the levels H1 through H7. At level H1, the holding fork 17 takes over an empty box 14 from the upper finger belt 20'. Subsequently, it is turned by 90 degrees by means of the swivel drive 18 and transferred to a variable working level that is defined according to the filling degree of the box 14 and to the particular working level H3 required. Once filling of the box 14 with collapsible tubes 1 is completed as desired, it is moved to level H5. To avoid collisions, level H6 is passed, and then the full box is placed on the lower finger belt 20 by means of the holding fork 17 and the swivel drive 18 at level H7 and is then transferred to a filling plant (not illustrated) or a store by means of the lower roller conveyor 21.

The apparatus is characterized in that there is always enough time for completing the respectively next working step, so that there are practically no problems arising in connection with the time available.